



Illinois Mathematics and Science Academy
1500 Sullivan Road
Aurora, IL 60506-1000

Application For SIR Placement at Fermi National Accelerator Laboratory (FNAL)

(provide two recommendations – see rec form; please use a computer to complete this application legibly)

Name: Moe George Herbert Date: 3/7/2015
Last First Middle month / day / year

Home Address: 1655 Burning Bush Ln
Number and Street

Hoffman Estates IL 60192 Home Telephone: (847) 963 6652
City State Zip Code (include area code)

Person to be notified in an emergency: Lisa Moe

Telephone (office hours): (224) 558 8275 Telephone (other hours): (224) 558 8275
(include area code) (include area code)

Student Cell Phone: (847) 502 5251 Year of Graduation: 2017

Suggested FNAL Advisor: _____

Gender: ☒ male ☐ female Age: 16 Country of Citizenship*: United States of America

*Citizens other than from the United States must complete the following information:

Permanent Resident: ☐ Yes ☐ No

Place of Birth: _____
(City, State, Country)

Passport No.: _____ Expiration Date: _____

All non-U.S. citizens must present their original, unexpired foreign passport on the first day of the program. Photocopies are not acceptable. Depending on your circumstances, you also must present:

- Form I-94 Arrival Departure Card that shows lawful admission to the U.S. and the end date of your “authorized stay”, **PLUS**:
 - Form I-797 Notice of Action approving H-4, O-3, TD, E-3 or other nonimmigrant (temporary) visa status in the U.S. , OR
 - Form DS-2019 Certificate of Eligibility for J-2 status, OR
 - Form I-20 showing F-2 status, **OR**
- Greencard (Alien Registration Card, or I-551 Card) showing grant of lawful permanent resident status.

Describe your skills, abilities, proficiencies; please be honest.

Highest Math Level/Skill: Single Variable Calculus: knowledge of derivatives, integration, Taylor series, error estimation;

Pre-calculus: trigonometry, vectors, matrices, the complex plane (rectangular and polar); Other: modulus and basic number theory, fractals, combinatorics and probability

Skill with Statistics: knowledge of Excel usage, descriptive statistics (mean, variance, standard deviation, etc.), t-test, correlation, best-fit line and R^2 , chi-square, ANOVA, Tukey

Science Classes: Physics: Newton’s laws, kinematics, gravitation, free-fall, momentum and impulse, energy, wave and fields; Biology: evolution theory, cell structure, DNA structure, protein synthesis, enzymes, protein pathways, properties of water and capillary action; Chemistry (current): periodic trends, diagramming and naming ionic and covalent compounds, polar molecules, electron orbitals, balancing equations, stoichiometry

Describe Your Laboratory Skills: LoggerPro use, Microscope use, Excel use, measuring and weighing (triple beam balance, electronic scale, graduated cylinder, etc.), pipetting

Prior Research (SIR) Experience (include advisor name/location): _____
None

Computer Proficiency: Please indicate your skill level for each of the below.

	none	introductory	intermediate	advanced
Basic		X		
C/C++			X	
Fortran	X			
Java			X	
Other Languages(list)			Python, Javascript, HTML, CSS, PHP	
Mathematica		X		
Matlab	X			
Other Programs (list)				
Unix(Linux)				X
Windows			X	
Mac		X		
Other OS (list)				

Rank Your Interests (Do not rank any area that you would not be willing to pursue an investigation in.)

9 Accelerator Component Testing, Theory and Design
3 Astrophysics Data Analysis, Detector Development, Theory
1 Computer Networking, Computing for Analysis, Data Analysis of Experiments, Computer Simulation and Modeling
5 Detector Design and Testing
 Electronics Design and Testing

 Instrumentation and Diagnostics
8 Radiofrequency (RF) Systems
7 Magnet Systems
 Mechanical Design and Development
6 Particle Physics Phenomenology
4 Particle Physics Theory
2 Superconducting Technology

Attach an application that includes the following items:

- Academic honors and awards that you have received. Please limit to ten or less honors/awards that you feel are the most significant.
- Extracurricular activities, interests, and any leadership role(s). Please limit to ten or less activities/interests that you feel are the most significant.
- Explain why research at FNAL would be a benefit to you and what you expect from participation in an investigation at FNAL. (Limit your answer to 250 words or less.)
- What would you tell a FNAL scientist about yourself so that you would be selected to work with her or him? (Limit your answer to 250 words or less.)
- Explain one exceptional experience you had with STEM in the last year. (Limit your answer to 250 words or less.)

Placement at FNAL also requires:

- Fermilab Visitor ID Form (form attached)
- Proof of Medical Coverage (form attached)
- Work Permit (required of students who are under 16 years of age)
- Documentation of Immigration Status (see first page)
- Authorization for Issuance of an ID Card (form attached)
- Student Registration (form attached)

- Note that some information is repeated on the attached forms, which will be filed with the appropriate offices at FNAL once a student has a specific placement.

*I understand that by submitting this application for placement at the **Fermi National Accelerator Laboratory** I may not apply for or seek other SIR opportunities until a decision has been made about this application. Placement for SIR at FNAL is not guaranteed by submission of this application.*

Signature of Parent/Guardian

Date

Signature of Applicant

Date



Illinois Mathematics and Science Academy
The World's Leading Teaching and Learning Laboratory for Imagination and Inquiry
**Student Inquiry and Research
Recommendation Form**

Student Name _____ **graduation year** _____

Recommender _____
(name) (email)

Recommender: The student listed above wishes to participate in the Student Inquiry and Research (SIR) Program. SIR advisors are frequently requesting additional information so your assistance is needed in recommending and evaluating students. This completed form, as a pdf file, may be sent to off-campus individuals to assist with best placement of students.

1. Please rate the student on each of the following criteria, with 5 being highest and 1 being lowest, based on your experiences with IMSA students.

Criteria	5	4	3	2	1	No basis for judgment
Motivation for the investigation						
Intellectual potential						
Ability to analyze/problem solve						
Teamwork skills						
Perseverance						
Maturity						
Works independently						
Communication skills						
Integrity						
Overall judgment						

Please comment on the preparedness of the student to participate in an independent investigation.

Is there anything else that you feel a potential advisor should know about this student?

RESUME

- Academic honors and awards that you have received. Please limit to ten or less honors/awards that you feel are the most significant.
- Extracurricular activities, interests, and any leadership role(s). Please limit to ten or less activities/interests that you feel are the most significant.
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Academic Honors and Awards

- 2013 – MATHCOUNTS Regional 4th place Individual
- 2013 – MATHCOUNTS Regional 2nd place Countdown Round
- 2013 – MATHCOUNTS State 5th place Team
- 2013 – Plum Grove Junior High School American Legion Award
- 2014 – ICTM State 5th place Calculator Team
- 2014 – William Fremd High School Viking Award
- 2015 – HiMCM Meritorious Award
- 2015 – Winnovation Flapjack Robotics Challenge First Place Champion Team

Extracurricular Activities, Interests, and Leadership

- 2015 – Chairman, #undefined Student Initiative Team
 - Invigorate the Student Union, a joint project with the IMSA Student Council to promote the formation of a community around the facilities provided around campus
 - Club Hub, an initiative to organize campus communications through a virtual poster wall
 - AskUndef, a Q&A forum (AskBot, similar to StackExchange) for the IMSA community.
- 2015 – IMSA Math Team (NSML)
- 2015 – Future Problem Solvers Team (solving problems set in the future)
- 2015 – American Computer Science League Contest
- 2015 – IMSA TALENT, IMSA's entrepreneurial program
 - Power Pitch, a contest for the best business pitch
- 2015 – Titan Robotics, FIRST Robotics Competition
- 2015 – SCAINET (Super Computing At IMSA), a project to build a computing cluster at IMSA
- 2015 – NASA Capillary Effects on Liquids Exploratory Research Experiments (CELERE)
- 2013-2014 – Patrol Leader, Assistant Senior Patrol Leader, Boy Scout Troop 209

Research at FNAL

Recently, I've been doing research on computer modeling and data analysis, but my efforts in such projects have been limited to casual personal experiments. At Fermilab, where supercomputing is used extensively to model particle physics and more, I'd like to learn how computer models are *really* constructed by the scientific community and applied to real-world datasets. By gaining an understanding on how computer models are designed, operated, and used, I will further my understanding and experience in computational science and be able to apply to more problems in research at Fermilab, in college, and in my career.

Having been to Fermilab frequently in the past, from STEM trips with Cub Scouts to listening to Alex Filippenko speak on "Dark Energy and the Runaway Universe," I'm also excited by the discoveries being made in particle physics, particularly in realm of quantum mechanics. I've done significant research on these concepts through documentaries and searching the web, but I hope to be able to actively gain a deep understanding of particle physics from working with researchers at Fermilab.

Indeed, this would be an excellent opportunity to learn how research is done by *real* scientists. In my science courses, we've done plenty of experiments, but these all take place under well-established research in the guided environment of the classroom. In the real world, and especially in the cutting-edge research at Fermilab, there's no hand-holding. At Fermilab, I'd like to learn how real-world scientists do research under vast unknowns to forward the frontier of science.

About Me

I have an advanced knowledge of programming. I started out in C++ in 3rd grade, and I have expanded to gain experience in web languages, such as Javascript and HTML, basic Android programming (Java), and, more recently, Python. With C++ and Python, I've done some personal projects aimed at parallel programming (through libraries like OpenMPI in C++ and `dispy` on Python). I have also experimented with the scientific processing capabilities of Python through modules such as `scikit`, `matplotlib`, and `numpy`. My latest project was a python program to render the Mandelbrot Set in very high resolution on IMSA's computing cluster, which I am working to build. I have a large programming portfolio as well as enough experience to learn new languages quickly.

I was involved in Boy Scouts for about 5 years. I started as the leader of a patrol of seven boys before ascending to the Head Assistant Patrol Leader of a troop of over 100 members. Thus, I'm skilled in communications, project organization, and time management.

Finally, I have a strong willingness to learn. I think this is a great opportunity to acquire a deep knowledge about the subject by learning from an expert in the field. There will be things I will not know—the only education I have in particle physics is from personal research on the web—but I am always enthusiastic about new concepts, so if there's anything I need to know to better contribute to research, I'm ready to learn with a passion.

Exceptional STEM

In fall of last year, I joined a team of friends in a computational contest called High School Mathematical Contest in Modeling (HiMCM) hosted by the Consortium for Mathematics and its Applications. We were given a problem about a mysterious outbreak of a disease resembling Ebola on an Indonesian island, and we were tasked with modeling its impacts and devising recommendations for its containment. Through this experience, I learned about the Susceptible-Infected-Recovered (S-I-R) model for modeling disease outbreaks, as well as where its differential equations are derived from. In order to solve the equations in the face of too many unknowns, we wrote a model in Python to simulate the spread of the disease from person to person over a geographical map. This model started with a user-defined island map, to which it added a couple of villages with realistic population distribution. It then iterated over each infected individual, and ran randomized disease transmission trials on each susceptible individual up to five units away—with probability in inverse-square relation to distance—in every direction. The results from these, though slightly randomized, heavily resembled the S-I-R curve, and we were able to find the disease parameters through enlightened guessing. In the end, we were awarded with a "Meritorious" ranking, a 5th place level rank. Nonetheless, it was an experience in STEM that's ignited my interest in computational modeling and data analysis in a way I'll never forget. I'm looking forward to doing it next year to learn and achieve something great!

Student Name: MOE, George Herbert
Date of Birth: 09/20/1998
Entry Date: 08/14/2014

Illinois Mathematics and Science Academy
School Code:140177

Y14-15

Grade 10	Literary Explorations I
Grade 10	Literary Explorations II
Grade 10	American Studies
Grade 10	BC Calculus II
Grade 10	BC Calculus III
Grade 10	Scientific Inquiries - Chemistry
Grade 10	Scientific Inquiries - Physics
Grade 10	Scientific Inquiries - Biology
Grade 10	Methods in Scientific Inquiry
Grade 10	Moving and Learning
Grade 10	French III

Sem1	Sem2	Credit
A		0.50
	A	0.50
A	A	1.00
A		0.50
	A	0.50
	A	0.50
A		0.50
A		0.50
A	A	0.50
A	A	0.50
A	A	1.00

Nancy M Stegmayer

Academic Program

All IMSA courses are college preparatory.

Explanation of Grades

A	Exceeds course requirements
B	Meets course requirements
C	Needs improvement
D	Does not meet course requirements; no Academy credit awarded
I	Incomplete, course requirements not completed when grades were issued
WF	Withdrawn from course with failing grade; no Academy credit awarded
W	Withdrawn from course; no Academy credit awarded

Pass/Fail Options

P+	Exceeds course requirements (Pass with Distinction, used only in Independent Study and Student Inquiry and Research courses)
P	Meets course requirements; Academy credit may/may not be awarded depending on course grading criteria
F	Does not meet course requirements for course taken pass/fail; no Academy credit awarded

Intersession (one week non-credit course)

S	Satisfactory completion of requirements
U	Unsatisfactory completion of requirements

GPA/Class Ranking Policy

In light of IMSA's selective admission process and in order to promote collaborative exploration and discovery, the Academy does not compute grade point averages and class rankings.

Standardized Test Scores

Standardized test scores are provided by the student.

Student Inquiry and Research

(Inquiry and Mentorship) includes on-campus and off-campus experiences in which students plan, investigate, analyze, and communicate in-depth scholarly investigation, either guided or directed, by scientists, scholars, and/or educators.

TALENT (Total Applied Learning for Entrepreneurs)

Is a program that promotes entrepreneurial applied science and technology.

Federal and State Constitution Requirements

Are fulfilled with successful completion of American Studies.

Physical Education Requirement

Is fulfilled with successful completion (pass) of physical education or wellness.

Notice to persons or agencies receiving student records:

Section 438(b)(4)(B) of U.S. Public Law 93-380 requires that this pupil record information be transferred to you only on condition that you will not permit any other party to have access to it without the written consent of a parent/guardian or eligible student.



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Phone 630-907-5066 Fax 630-907-5922



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Student Inquiry and Research
Recommendation Form

Student Name George Moe **graduation year** 2017

Recommender Ruth Dover **dover@imsa.edu**
(name) (email)

Recommender: The student listed above wishes to participate in the Student Inquiry and Research (SIR) Program. SIR advisors are frequently requesting additional information so your assistance is needed in recommending and evaluating students. This completed form, as a pdf file, may be sent to off-campus individuals to assist with best placement of students.

1. Please rate the student on each of the following criteria, with 5 being highest and 1 being lowest, based on your experiences with IMSA students.

Criteria	5	4	3	2	1	No basis for judgment
Motivation for the investigation	x					
Intellectual potential	X!					
Ability to analyze/problem solve	x					
Teamwork skills	x					
Perseverance	x					
Maturity	x					
Works independently	x					
Communication skills	x					
Integrity	x					
Overall judgment	x					

Please comment on the preparedness of the student to participate in an independent investigation.

George is a sophomore in my BC 2 and 3 classes this year – a rarity. He is certainly one of my top 2 or 3 students out of two sections in terms of mathematics. And he is clearly more mature than most. Just impressive! He writes well and he thinks through many details that others don't even notice. Moreover, he works well with his tablemates and he is patient with weaker students in the class. We did a little work with *Mathematica* and he jumped in to learn a lot more. He has done quite a bit on his own with the software.

Really, he is mature, very strong academically, organized, etc., etc. Couldn't be better!

Is there anything else that you feel a potential advisor should know about this student?

Any good advisor would be lucky to get him!